2.0 Indiana bat *(Myotis sodalis)*

2.1 Status of the Species

This section presents the biological or ecological information relevant to formulating the biological opinion. Appropriate information on the species' life history, its habitat and distribution, and other data on factors necessary to its survival are included to provide background for analysis in later sections. This analysis documents the effects of past human and natural activities or events that have led to the current range-wide status of the species. Portions of this information are also presented in listing documents, the recovery plan (USFWS 1983), the draft revised recovery plan (USFWS 1999), the Final Biological Opinion for the Operation and Maintenance of the 9-Foot Navigation Channel on the Upper Mississippi River System (USFWS 2000), and the Biological Assessment of the Upper Mississippi River-Illinois Waterway System Navigation Study (USACE 2004) and are referenced accordingly.

2.1.1 Species/critical habitat description

The Indiana bat *(Myotis sodalis)* was listed as an endangered species on March 11, 1967 *(Federal Register* 32[48]:4001) under the Endangered Species Preservation Act of October 15, 1966 (80 Stat. 926; 16 U. S. C. 668aa[c]). Eleven caves and two mines in six states were listed as critical habitat on September 24, 1976 (41 FR 41914). These sites along with other known hibernacula were classified in the Indiana Bat Recovery Plan as Priority One, containing at least 30,000 bats; Priority Two, containing 1000 to fewer than 30,000; and Priority Three with less than 1,000 bats (USFWS 1983). In the 1999 draft revised Recovery Plan, the Priority Two lower limit was reduced to 500 bats. In summary, the objectives of the Recovery Plan are to: (1) protect hibernacula; (2) maintain, protect, and restore summer maternity habitat; and (3) monitor population trends through winter censuses.

2.1.2 Life history

The Indiana bat is a medium-sized bat with a head and body length that ranges from 41 to 49 mm. The fur is described as dull pinkish-brown on the back, and somewhat lighter on the chest and belly. The ears and wing membranes do not contrast with the fur. There are no recognized subspecies. Generally, Indiana bats hibernate from October through April (Hall 1962, LaVal and LaVal 1980), depending upon local weather conditions. Figure 2-1 provides a depiction of the annual cycle). They hibernate in large, dense clusters, ranging from 300 bats per square foot to 484 bats per square foot (Clawson *et al*. 1980, Clawson, pers. observ. October 1996 *in* USFWS 2000). Upon arrival at hibernating caves in August-September, Indiana bats "swarm," a behavior in which large numbers of bats fly in and out of cave entrances from dusk to dawn, with relatively few roosting in the caves during the day (Cope and Humphrey 1977). Swarming continues for several weeks and mating occurs during the latter part of the period. Fat supplies are replenished as the bats forage prior to hibernation.

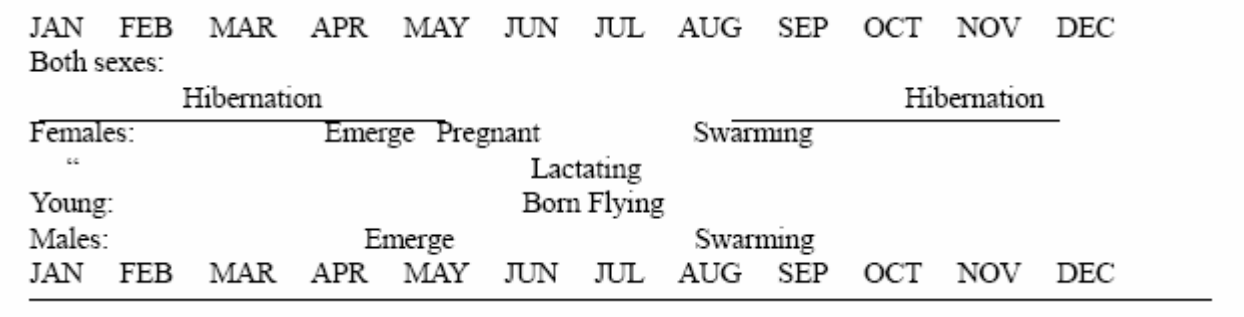

Figure 2-1. Indiana Bat Annual Chronology

Indiana bats tend to hibernate in the same cave at which they swarm (LaVal et al. 1976), although swarming has occurred at caves other than those in which the bats hibernated (Cope and Humphrey 1977). During swarming, males remain active over a longer period of time at cave entrances than do females (LaVal and LaVal 1980), probably to mate with the females as they arrive. After mating, females enter directly into hibernation. A majority of bats of both sexes hibernate by the end of November [by mid-October in northern areas (Kurta, pers. observ. June 1997)], but hibernacula populations may increase throughout the fall and even into early January (Clawson et al. 1980).

Indiana bats forage over a variety of habitat types but prefer to forage in and around the tree canopy of both upland and bottomland forest or along the corridors of small streams. Bats forage at a height of approximately 2-30 meters under riparian and floodplain trees (Humphrey et al. 1977). They forage between dusk and dawn and feed exclusively on flying insects, primarily moths, beetles, and aquatic insects. Females in Illinois were found to forage most frequently in areas with canopy cover of greater than 80% (Garner and Gardner 1992). The species feeds on flying insects, both aquatic and terrestrial. Diet appears to vary across the range, as well as seasonally and with age, sex and reproductive status (Murray and Kurta 2002, Lee 1993, Belwood 1979). Murray and Kurta (2002) found that diet is somewhat flexible across the range and that prey consumed is potentially affected by regional and local differences in bat assemblages and/or availability of foraging habitats and prey. For example, Lee (1993) and Murray and Kurta (2002) found that adult aquatic insects (Trichoptera and Diptera) made up 25-81% of Indiana bat diets in northern Indiana and Michigan. However, in the southern part of the species range terrestrial insects (Lepidoptera) were the most abundant prey items (as high as 85%) (Lee 1993, Brack and LeVal 1985, LaVal and Laval 1980, Belwood 1979). Kiser and Elliot (1996) found that Lepidopterans (moths), Coleopterans (beetles), Dipterans (true flies) and Homopterans (leafhoppers) accounted for the majority of prey items (87.9% and 93.5% combined for 1994 and 1995, respectively) consumed by male Indiana bats in their study in Kentucky. Diptera, Trichoptera, Lepidoptera, and Coleopterans also comprised the main prey of Indiana bats in Michigan (Murray and Kurta 2002); however, Hymenopterans (alate ants) were also taken when abundant.

Reproductively active females and juveniles exhibit greater dietary diversity than males and non-reproductively active adult females. Lee (1993) found that reproductively active females eat more aquatic insects than adult males or juveniles in Indiana. These differences in dietary demands between age groups, sex and reproductive stage is perhaps due to higher energy demands of reproductive females and juveniles. Male Indiana bats summering in or near a hibernation cave feed preferentially on moths and beetles.

Adult females store sperm through the winter and become pregnant via delayed fertilization soon after emergence from hibernation. Young female bats can mate in their first autumn and have offspring the following year, whereas males may not mature until the second year. Limited mating activity occurs throughout the winter and in late April as the bats leave hibernation (Hall 1962).

Females emerge from hibernation ahead of males; most winter populations leave by early May. The first maternity colony was found and several studies of Indiana bat maternity habitat were conducted in the Midwest region (Cope et al 1974). Females migrate up to 500 km northward (Kurta & Murray 2002), to form maternity colonies consisting 10 to 100 adults (Murray & Kurta 2004).

Some males spend the summer near hibernacula in Missouri (LaVal and LaVal 1980) and West Virginia (Stihler, pers. observ. October 1996, *in* USFWS 2000). In spring when fat reserves and food supplies are low, migration is probably hazardous (Tuttle and Stevenson 1977). Consequently, mortality may be higher in the early spring, immediately following emergence.

Females may arrive in their summer habitats as early as April 15 in Illinois (Gardner et al. 1991a, Brack 1979). During this early spring period, a number of roosts (e.g., small cavities) may be used temporarily, until a roost with larger numbers of bats is established. Humphrey et al. (1977) reported that Indiana bats first arrived at their maternity roost in early May in Indiana, with substantial numbers arriving in mid-May. Parturition occurs in late June and early July (Easterla and Watkins 1969, Humphrey et al. 1977) and the young are able to fly between mid-July and early August (Mumford and Cope 1958, Cope et al. 1974, Humphrey et al. 1977, Clark et al. 1987, Gardner et al 1991a, Kurta et al. 1996).

Female Indiana bats exhibit strong site fidelity to summer roosting and foraging areas, that is, they return to the same summer range annually to bear their young. Females typically utilize larger foraging ranges than males (Garner and Gardner 1992). Maternal activity has been recorded at approximately 233 locations rangewide (Barbara Douglas USFWS , pers. com.. 2004), by the capture of reproductive females (pregnant or lactating). The top five States by total records are Indiana (83), Illinois (38), Iowa (25), Kentucky (21), and Missouri (20). These states, along with Michigan and Ohio are considered to be the species' core maternity range.

Male Indiana bats may be found throughout the entire range of the species. Males appear to roost singly or in small groups, except during brief summer visits to hibernacula. Males have been observed roosting in trees as small as 3 inch diameter at breast height (dbh).

The species range includes much of the eastern half of the United States, from Oklahoma, Iowa, and Wisconsin east to Vermont, and south to northwestern Florida. The Indiana bat is migratory, and the above described range includes both winter and summer habitat. The winter range is associated with regions of well-developed limestone caverns. Major populations of this species hibernate in Indiana, Kentucky, and Missouri. Smaller winter populations have been reported from Alabama, Arkansas, Georgia, Illinois, Maryland, Mississippi, New York, North Carolina, Ohio, Oklahoma, Pennsylvania, Tennessee, Virginia, and West Virginia. More than 85% of the entire known population of Indiana bats hibernates in only nine caves.

2.1.3 Population dynamics

Based on censuses taken at all hibernacula, the total known Indiana bat population is estimated to number about 382,350 bats (Table 2-1). The most severe declines in wintering populations have occurred in two states: Kentucky, where 200,200 bats were lost between 1960 and 2001, and Missouri, where 326,000 Indiana bats were estimated to be lost in the same period. In Indiana, populations dropped by 50,000 between the earliest censuses and 1980, but have returned to former levels in recent years. Currently, almost half of all the hibernating Indiana bats in existence (approximately 173,100) winter in Indiana.

Table 2-1.—Size of hibernating populations of the Indiana bat by region and state, based upon estimates nearest to the year indicated (Clawson 2002).

	1960/1970	1980	1990	2000/2001
Southern Region				
Alabama	350	350	350	250
Arkansas	15,000	15,000	4,500	2,500
Kentucky	248,100	102,200	78,700	47,900
Missouri	399,000	342,000	150,100	73,000
Tennessee	20,100	20,100	16,400	10,200
Virginia	3,100	2,500	1,900	1,000
Subtotal	685,650	482,150	251,950	134,850
Northern Region				
Illinois	14,800	14,800	14,900	19,300
Indiana	160,300	155,200	163,500	173,100
New York	20,200	21,100	26,800	34,900
Ohio	150	3,600	9,500	9,800
Pennsylvania	700	700	400	700
West Virginia	1,500	1,200	6,500	9,700
Subtotal	197,650	196,600	221,600	247,500
Grand total	883,300	678,750	473,550	382,350

[a] Not all surveys occurred exactly in the winter indicated. Population estimates for a particular period were based on the survey nearest to the year indicated, either prior to or subsequent to that year, so that all caves are represented in each period.
[b] States with records of fewer than 100 hibernating Indiana bats were not listed.
[c] Data were from 1998–1999.

Missouri currently holds the second largest hibernating population of Indiana bats and Illinois holds the fifth largest hibernating population (Clawson 2002). Indiana bat populations first were first surveyed in the late 1950s (Hall 1962). In the decades since then, the total rangewide population of Indiana bats declined 57% (Clawson 2002). Regional trends contrast sharply, with the southern states losing approximately 80% over the survey period, and the northern states gaining 30% (Clawson 2002).

Trees in excess of 16 inch dbh with exfoliating bark are considered optimal for maternity colony roost sites, but trees in excess of 9 inch dbh appear to provide suitable maternity roosting habitat (Romme et al. 1995). Cavities and crevices in trees may also be used for roosting. In Illinois, Gardner et al. (1991) found that forested stream corridors and impounded bodies of water, were preferred foraging habitats for pregnant and lactating Indiana bats.

After the summer maternity period, Indiana bats migrate back to traditional winter hibernacula. Some male bats may begin to arrive at hibernacula as early as July. Females typically arrive later and by September the number of males and females are almost equal. Autumn "swarming" occurs prior to hibernation. During swarming, bats fly in and out of cave entrances from dusk to dawn, while relatively few roost in the caves during the day. By late September many females have entered hibernation, but males may continue swarming well into October in what is believed to be an attempt to breed with late arriving females.

2.1.4 Status and distribution

The current status and distribution of the species is described above. The reasons for listing the species were summarized in the original Recovery Plan as (1) Hibernating populations in Missouri have shown a decline over the last seven years despite an intensive cave management program; (2) The largest known hibernating population at Pilot Knob Mine, Missouri, continues to be threatened by subsidence (mine collapse); (3) Kentucky hibernating populations are not protected adequately and continue to be depressed (USFWS 1983). Clawson (2002) provided that the hibernating populations in Missouri have continued to decline, Pilot Knob Mine has undergone continued subsidence to the point at which it is unsafe to enter for survey, and Kentucky hibernating populations have also continued to decline. The species' range-wide trend is described in *Population dynamics*, preceding.

Reasons for Decline

Not all of the causes of Indiana bat population declines have been determined; the decline of the species at its current rate is unknown. Although several known human-related factors have caused declines in the past, they may not solely be responsible for recent declines.

Documented causes of Indiana bat population decline include:

Disturbance and vandalism - A serious cause of Indiana bat decline has been human disturbance of hibernating bats during the decades of the 1960s through the 1980s. Bats enter hibernation with only enough fat reserves to last until spring. When a bat is aroused, as much as 68 days of fat supply is used in a single disturbance (Thomas et al. 1990). Humans use (e.g., including recreational cavers and researchers) near hibernating Indiana bats can cause arousal (Humphrey 1978, Thomas 1995, Johnson *et al.* 1998). If this happens too often, the bats' fat reserves may be exhausted before the species is able to forage in the spring.

Active programs by State and Federal agencies have led to the acquisition and protection of a number of Indiana bat hibernacula. Of 127 caves/mines with populations >100 bats, 54 (43%) are in public ownership or control, and most of the 46 (36%) that are gated or fenced are on public land. Although such conservation efforts have been successful in protecting Indiana bats from human disturbance, they have not been sufficient to reverse the downward trend in many populations.

Improper cave gates and structures - Some hibernacula have been rendered unavailable to Indiana bats by the erection of solid gates in the entrances (Humphrey 1978). Since the 1950's, the exclusion of Indiana bats from caves and changes in air flow are the major cause of loss in Kentucky (an estimated 200,000 bats at three caves) (USFWS 1999). Other cave gates have so

modified the climate of hibernacula that Indiana bats were unable to survive the winter because changes in air flow elevated temperatures which caused an increase in metabolic rate and a premature exhaustion of fat reserves (Richter *et al.* 1993).

Natural hazards - Indiana bats are subject to a number of natural hazards. River flooding in Bat Cave, Mammoth Cave National Park, drowned large numbers of Indiana bats (Hall 1962). Other cases of hibernacula being flooded have been recorded by Hall (1962), DeBlase *et al.* (1965), and USFWS (1999). A case of internal cave flooding occurred when tree slash and debris (produced by forest clearing to convert the land to pasture) were bulldozed into a sinkhole, blocking the cave's rain water outlet and drowning an estimated 150 Indiana bats (USFWS 1999).

Another hazard exists because Indiana bats hibernate in cool portions of caves that tend to be near entrances, or where cold air is trapped. Some bats may freeze to death during severe winters (Humphrey 1978, Richter *et al.* 1993). Indiana bats are vulnerable to the effects of severe weather when roosting under exfoliating bark during summer. For example, a maternity colony was displaced when strong winds and hail produced by a thunderstorm stripped the bark from their cottonwood roost and the bats were forced to move to another roost (USFWS 1999).

Suspected causes of Indiana bat decline include:

Microclimate effects - Changes in the microclimates of caves and mines may have contributed more to the decline in population levels of the Indiana bat than previously estimated (Tuttle, *in litt.* August 4, 1998). Entrances and internal passages essential to air flow may become larger, smaller, or close altogether, with concomitant increases or decreases in air flow. Blockage of entry points, even those too small to be recognized, can be extremely important in hibernacula that require chimney-effect air flow to function. As suggested by Richter *et al.* (1993) and Tuttle (*in litt.* August 4, 1998), changes in air flow can elevate temperatures which can cause an increase in metabolic rate and a premature exhaustion of fat reserves.

Hibernacula in the southern portions of the Indiana bat's range may be either near the warm edge of the bat's hibernating tolerance or have relatively less stable temperatures. Hibernacula in the North may have passages that become too cold. In the former case, bats may be forced to roost near entrances or floors to find low enough temperatures, thus increasing their vulnerability to freezing or predation. In the North, bats must be able to escape particularly cold temperatures. In both cases, modifications that obstruct air flow or bat movement could adversely impact the species (USFWS 1999).

Land use practices - The Indiana bats' maternity range has changed dramatically since pre-settlement times (Schroeder 1991; Giessman *et al.* 1986; MacCleery 1992; Nigh *et al.* 1992). Most of the forest in the upper Midwest has been fragmented, fire has been suppressed, and native prairies have been converted to agricultural crops or to pasture and hay meadows for livestock. Native plant species have been replaced with exotics in large portions of the maternity range, and plant communities have become less diverse than occurred prior to settlement. Additionally, numerous chemicals are applied to these intensely- cropped areas. The changes in the landscape and the use of chemicals (McFarland 1998) may have reduced the availability and abundance of the bats' insect forage base.

In the eastern U. S., the area of land covered by forest has been increasing in recent years (MacCleery 1992). Whether or not this is beneficial to the Indiana bat is unknown. The age, composition, and size class distribution of the woodlands will have a bearing on their suitability as roosting and foraging habitat for the species outside the winter hibernation season.

Chemical contamination - Pesticides have been implicated in the declines of a number of insectivorous bats in North America (Mohr 1972, Reidinger 1972, Reidinger 1976, Clark and Prouty 1976, Clark *et al.* 1978, Geluso *et al.* 1976, Clark 1981). The effects of pesticides on Indiana bats have yet to be studied. McFarland (1998) studied two sympatric species, the little brown bat *(Myotis lucifugus)* and the northern long-eared bat *(M. septentrionalis keenii)* as surrogates in northern Missouri and documented depressed levels of acetylcholinesterase, suggesting that bats there may be exposed to sublethal levels of organophosphate and/or carbamate insecticides applied to agricultural crops. McFarland (1998) also demonstrated that bats in northern Missouri are exposed to significant amounts of agricultural chemicals, especially those applied to corn. BHE Environmental, Inc. (1999) collected tissue and guano samples from five species of bats at Fort Leonard Wood, Missouri and documented the exposure of bats to p,p'-DDE, heptachlor epoxide, and dieldrin.

2.2 Environmental Baseline

This section is an analysis of the effects of past and ongoing human and natural factors leading to the current status of the species, its habitat, and ecosystem within the action area. The purpose is to describe the current status of the species within the action area and those factors that have contributed to this state. Factors affecting the species include those listed previously under Reasons for Decline. Other factors with the potential to adversely roosting habitat include pulpwood management by private industry on islands in the Open River reach, woodlot management and wetland drainage by floodplain landowners, and land management activities by the States of Missouri and Illinois.

Much of the UMRS corridor represents potential summer habitat for the Indiana bat. Due to their migratory behavior, Indiana bats likely traverse or follow the Mississippi and Illinois River corridors en route to their summer habitats and in returning to their hibernacula. In doing so, they may stop and roost temporarily in suitable floodplain trees, or may select an area to spend the summer in a maternity colony.

2.2.1 Status of the Indiana bat within the action area

The action area includes the UMRS and its floodplain in 5 states. Two of these states, Illinois and Missouri, provide hibernacula designated as critical habitat. Missouri critical habitat consists of 5 caves and 1 mine in counties well outside the action area. However there are 3 counties in the action area containing Priority Three hibernacula. In Illinois, there are four Priority 2 hibernacula and two Priority 3 hibernacula in or directly adjacent to the action area, one of which is designated as critical habitat. As noted previously Missouri currently holds the second largest hibernating population of Indiana bats and Illinois holds the fifth largest hibernating population (Clawson 2002).

In Illinois, the majority of maternity colonies located have been found in bottomlands (T.Carter, SIU-C, 2004. Pers com.) roosting habitat in general contained more bottomland habitat and

patches of water (Carter et al 2002). Surveys indicate that the southern portion of the action area is providing suitable summer foraging and maternity habitat (Gardner 1990, Gardner et al 1996, WDH 2002). Indiana bats demonstrate roost area fidelity (Gardner 1991, Kurta 1996, Gumbert, 2002). In addition they have been found to establish multiple roost areas within 4.75 kilometers (2.9 miles) of a hibernaculum (Gumbert 2002). As noted above, one cave which provides critical habitat is located adjacent to the action area and is within 1.5 miles of the navigation channel. Males and lactating female Indiana bats have been captured in the action area in Illinois and Missouri, and tracked to roost trees on islands and the floodplain (QST 1997, WDHES 2002, Illinois DNR unpublished 1990, Gardner et al. 1996). The action area contains a variety of habitats where the species could forage, although there are no recent summer capture records northward of Henderson County on the Mississippi River and Ford County, south of the Illinois River. These habitats include floodplain forest, backwaters, sloughs, and open water. It is likely that Indiana bats within the project vicinity will forage upon both aquatic and terrestrial insects near the canopy of floodplain forests. Floodplain forest adjacent to known hibernacula could provide other key features necessary to the Indiana bat life cycle (e.g.. swarming) and is consequently important to viability of the species. We believe it reasonable that the species may be encountered throughout the Mississippi River portion of the action area south of Muscatine, Iowa and throughout the Illinois River portion of the action area downstream from Marseilles, Illinois.

2.2.2 Factors affecting the Indiana bat environment within the action area

Disturbance and vandalism, improper gates natural hazards microclimate changes, land use in maternity range, and contaminants were discussed in status of the species, preceding. Acquisition of lands associated with the 9-Foot navigation Channel Project in the 1930s allowed a shift in landcover from agriculture to bottomland forest on those lands over the last seventy years. At this time there are 27,230 acres of forested lands in the Rock Island District on Pools 17-22, and 37,090 acres of forested land in the St Louis District from Pool 24 southward. The State of Illinois owns over 60,000 acres on the Illinois Waterway from the Peoria Pool to its confluence with the Mississippi, and the bulk of that is forested. The State of Missouri owns over 23,000 acres on the UMRS above the Ohio River confluence. The floodplain forests of the UMRS are dominated by mixes of silver maple communities that occur in even-aged stands between 50 and 70 years old, and there is limited regeneration of silver maple or other trees present (UMRCC 2002). Due to this current condition, about 60 percent of forest lands in Federal ownership on the UMRS are estimated to provide an average of 40 trees per acre that provide roost tree structural features such as loose, exfoliating bark, or are dead or dying trees over 9 inches dbh (Gary Swenson, USACE pers. com. 2004). Due to limited regeneration and even-age structure, the long-term maintenance of suitable summer habitat is questionable. Despite the apparent abundance of seemingly suitable habitat, survey efforts have been infrequent, and evidence of habitat occupation is limited to the studies previously noted. It is difficult to determine the importance of the action area to recovery of the species in the absence of additional research, but given the life history information preceding, it is likely that portions of the action area are valuable maternity habitat and contribute to successful reproduction and recruitment.

The Final Biological Opinion for the Operation and Maintenance of the 9-Foot Navigation Channel on the Upper Mississippi River System (O&M BO) outlined a number of navigation-

related factors that may affect the species including impoundment and water level regulation, dredging and disposal, clearing and snagging, channel [regulating] structures and revetment, tow traffic, fleeting, port facilities, exotic species, contaminants, recreation, cabin leases, and General Plan Lands management.

2.3 Effects of the Action

This section includes an analysis of the direct and indirect effects of the proposed action on the species and/or its critical habitat and its interrelated and interdependent activities.

The Upper Mississippi River-Illinois Waterway System Navigation Study proposes to implement both navigation improvement and ecosystem restoration actions. The navigation improvement program also contains a mitigation component for unavoidable adverse impacts to natural resources of the UMRS.

The proposed action (project) is the implementation of the recommended plan contained in the Draft Integrated Feasibility Report and Programmatic EIS for the Upper Mississippi River-Illinois Waterway System Navigation Feasibility Study (USACE 2004). With the enactment of additional authorities, this project would include Federal policy changes, interagency coordinating mechanism or institutional arrangement modifications, changes in operation of existing facilities, manipulation of landcover types to change habitat features, and a suite of construction activities for navigation feature improvement, navigation structure modification, and ecosystem restoration.

Conservation measures to minimize harm to listed species which are proposed by the action agency are also considered part of the proposed project and their implementation is required under the terms of the consultation. The Corps included the following Conservation Measures by reference in its March 2004 Biological Assessment:

- Any activities that are determined to impact potential Indiana bat habitat will prohibit tree removal/clearing during the period of April 1 to September 30, unless mist net surveys indicate that no bats are present and there is no known roosting at the site. If a site is within a 5-mile radius of hibernacula, the period is April 1 to November 15.

- Forest management efforts within the range of the Indiana bat will be carried out to establish and maintain forest species and size class diversity in order to ensure a long-term supply of potential Indiana bat roosting trees.

- Current Corps of Engineers operations and maintenance programs will be evaluated to determine if additional opportunities exist to promote hardwood regeneration and species diversity in floodplain forests.

Through subsequent correspondence during consultation, the agency also provided the following conservation measure:

- Tree removal, timber stand improvement, and other activities determined to affect potential Indiana bat habitat will be conducted in a manner that does not adversely alter

the character or habitat suitability of subject sites. Site boundaries will be determined in collaboration with the Service, respective State, and other resource experts as necessary.

Short term local impacts to individual Indiana bats in the action area during construction activity described below are expected to be outweighed by the long term landscape level benefits of proposed ecosystem restoration measures. Improved forest species diversity and structural diversity would be expected to contribute to a long term supply of suitable roost trees. Restoration measures directed at aquatic habitat improvement should contribute to the species' forage base.

2.3.1 Direct effects

2.3.1.1 Navigation improvements

Navigation improvements with the potential to affect Indiana bats were screened and provided in BA Table 1 (USACE 2004). Effects would be realized as injury or direct mortality to adults and young bats from roost tree toppling by navigation-induced erosion, casual mooring, or fleeting; tree removal for bank shaping and armoring; and energetic stress from increased foraging and searching for new suitable foraging areas, roost areas, and roost trees by pregnant females. These effects would be likely to contribute to lower reproductive success in the action area, if roosting and foraging areas are limited at the project or site-specific scale. Clearing for construction staging, or other landcover modification close to hibernacula could alter site characteristics by reducing available roost trees, changing foraging patterns or distances, and affecting fat accumulation for swarming bats, and consequently, reducing over-winter survival, resulting in unquantified take of Indiana bats. Activities occurring near hibernacula during the swarming period may also affect mating success, and thus reproductive success of the population.

The proposed conservation measures, however, are anticipated to minimize the level of exposure and the extent of impact such that neither reproductive success nor survival will be appreciably affected. First, the proposed conservation measures include restricting activities to periods when bats are not likely to be using the area. This will reduce, if not eliminate, nearly all direct exposure to project impacts. Second, the proposed conservation measures also include maintaining the character of project sites in terms of Indiana bat habitat suitability. Thus, we expect that despite alterations of habitat will occur in conjunction with navigation improvement projects, the suitability of the targeted sites will not be reduced. Although the Corps may not be successful in maintaining the character of the site every time, based on past experiences, we fully expect that through Tier II consultations exceptions will be rare. Third, the closest known hibernacula to a lock site is on the Illinois Waterway, where no additional lock work is currently proposed; therefore, the likelihood of impact to swarming and hibernating bats from navigation improvement is extremely low, and therefore, discountable.

Most of the large-scale navigation improvements which would require staging areas and forest clearing for new construction are located in the mid to lower portions of the UMRS, where Indiana bats have been collected. Table 2-2 provides the projected permanent and temporary clearing for navigation improvements, and the approximate date range for clearing and replanting temporary staging areas (USACE 1998). This acreage represents about 0.0005

percent of the total 269,404 acres of forested habitat from Pool 17 southward on the Mississippi and Peoria Pool southward on the Illinois River.

Table 2-2. Forest clearing for navigation improvements.

	Permanent	Temporary	Total	Clear NST	Replant NLT
Lock and Dam 20	15 ac		15.0	2011	n/a
Lock and Dam 21	8 ac	4.5 ac	12.5	2008	2021
Lock and Dam 22	22 ac		22.0	2005	n/a
Lock and Dam 24		5.8 ac	5.8	2008	2021
Lock and Dam 25	24 ac		24.0	2005	n/a
Peoria L & D		12.5 ac	12.5	2011	2026
LaGrange L & D	24 ac	19 ac	43	2008	2022
Total			134.8 acres		

While it may be possible to avoid most direct impacts to roosting areas and maternal colonies by scheduling construction/clearing during the non-hibernation season, it is unlikely that all direct impacts will be avoided over the 50 year project period. In addition, tree clearing and general silvicultural practices as part of forest management scheduled during the hibernation period can still alter the characteristics of suitable habitat (roost areas), rendering them unavailable to pregnant bats demonstrating roosting area and/or roost tree fidelity upon emergence in the spring. We anticipate that very few instances will arise where adverse effects will be unavoidable. In those instances where unavoidable, reproduction, numbers, or distribution of Indiana bats within the action area are not likely to be appreciably reduced due to the implementation of the conservation measures proposed.

2.3.1.2 Mitigation

Mitigation planning for impacts associated with incremental increases in navigation traffic fall into four major biological areas – fishery, submersed aquatic plants, bank erosion, and backwater-side channel sedimentation. Fishery mitigation measures include large woody debris anchors, backwater improvements, dike alterations, and fish passage. Submerged aquatic plant mitigation measures include modification of river regulation to improve habitat conditions, backwater/side channel habitat protection and restoration and revegetation. Bank erosion mitigation measures include such structural measures as offshore revetments, bank protection, or vegetative/bioengineered protection. Mitigation for backwater/side channel sedimentation measures includes offshore revetment, drop structures, closure structures, bank protection, barrier island construction, and dredging.

At the programmatic scale, mitigation measures associated with erosion and bank protection have the potential to impact Indiana bats through removal of bankline trees during bank shaping activity. Per the proposed conservation measures, the Corps will coordinate with State and Federal resource agencies to evaluate site characteristics and suitability, and will develop site-specific project plans to preserve site suitability. We anticipate that only in a very few instances will adverse effects be unavoidable. In these situations, it is unlikely that an entire bat colony will be affected and activities would be limited to removal of a few trees. Furthermore, it is extremely unlikely that any such project would be implemented if maternity activity is verified.

Thus, although we anticipate that a few individuals may be harmed, we do not expect the reproduction, numbers or distribution of Indiana bats will be appreciably reduced from mitigation activities.

Because mitigation measures proposed to date are similar to the ecosystem restoration component of the Upper Mississippi River-Illinois Waterway System Navigation Study, these actions are evaluated subsequently in greater detail in the Ecosystem Restoration section of this biological opinion.

2.3.1.3 Ecosystem restoration

Restoration projects are proposed to alter and improve habitat conditions on up to an estimated 96,500 acres on the Mississippi River (below Rock Island) and Illinois River portions of the study area. This acreage is considered "area of influence," as individual project footprints may be smaller, actions should positively influence habitat quality within a larger contiguous area or area of influence. This figure represents approximately 36 percent of the total forested acreage from Pool 17 southward on the Mississippi and Peoria Pool southward on the Illinois. The estimated annual average acreage of forested habitat associated with ecosystem restoration work is 511 acres. Descriptions of proposed ecosystem restoration measures are summarized in *Project Description* preceding, pages 7 - 12. Generally speaking we anticipate that activities associated with ecosystem restoration will not appreciably affect reproduction, numbers, or the distribution of Indian bats within the action area. Proposed conservation measures include mechanisms to avoid direct exposure to impacts and ensure site suitability and characteristics are maintained. Therefore, potential impacts (as specifically described below) to Indiana bats from actions implemented per the ecosystem restoration component of the project are expected to be minor. Portions of the action area fall within a five mile radius of known hibernacula; however, these hibernacula are well removed from the action area by topography and are not expected to fall within the boundaries of proposed ecosystem restoration measures. Thus, we anticipate that the likelihood of impact to swarming or hibernating bats from ecosystem restoration activities is extremely low and therefore discountable.

Island Building

Island building is primarily a process of dredging and placement of dredged material for the express purpose of restoring an eroded feature or providing wind and wave protection to reduce sediment resuspension, improve water clarity, provide bathymetric diversity necessary to provided habitat for a range of aquatic life stages, and provide the topographic diversity necessary to provide a range of terrestrial habitats representative of the specific river reach. No detectable effects to Indiana bats would be expected during island construction. Over the project life, some islands would be expected to be planted with preferred species or be allowed to reforest naturally. This would be expected to contribute to long-term forest species diversity and structural diversity beneficial to forest-dwelling bats, including the Indiana bat.

Fish Passage

Fish passage involving reestablishment of lateral hydraulic connectivity could involve tree removal and construction-related disturbance during the non-hibernation period. In the portion of the action area where Indiana bats may be found, reestablishing lateral connectivity is likely to

involve deployment and operation of standard construction equipment to modify flood control levees and channels. Alteration of foraging habitat or roosting area characteristics via tree removal and disruption of foraging would adversely affect the Indiana bat on a temporary basis, as modification of forested habitat is expected to be insignificant with implementation of the proposed conservation measures. No effects to Indiana bats are anticipated from fish passage construction at lock and dam facilities, as no forested habitat will be involved in the projects.

Floodplain Restoration

Floodplain restoration, as described previously, includes a range of passive measures to restore and manage representative ecotypes, as well as aggressive construction measures typical of floodplain development and flood control projects. These activities occurring in close proximity to maternal roost trees or roosting areas would be expected to influence reproductive success, resulting in take of the species, if sufficient alternative roosting habitat is unavailable. Floodplain restoration includes timber stand improvement, clearing for grassland restoration, or other landcover modification that has the potential to affect area characteristics close to hibernacula and could alter site characteristics by reducing available roost trees and changing foraging patterns or distances, also resulting in take. Grassland restoration typically involves periodic burning to control undesirable species and woody encroachment. Burning on federally owned General Plan Lands below Rock Island is typically carried out by Service Refuge personnel following detailed burn plans, under the Refuge Comprehensive Conservation Plan. Of the average combined estimate of 3000 acre per year acreage target, Refuge staff indicates that about 10% or 300 acres of that would occur in the vicinity of bottomland forest or forested wetland habitat in the action area (Tim Julison, USFWS, pers. comm. 2004). Another 1200 acre General Plan tract managed by the State of Missouri is being converted to open wetland and is being managed with a combination of herbicide, burning, and mechanical means to control canary grass invasion and promote native wetland vegetation. Burning on State-managed lands in the action area is minimal and has been confined to about 150 acres in Iowa on Pool 17 to favor oak regeneration over silver maple, and set back invasive canary grass. In Illinois, burning is rare on the floodplain, involving about 300 acres directed at managing willow encroachment in wetland units as necessary. Burning on the U.S. Forest Service Inageh Unit of the Shawnee National Forest currently involves up to 300 acres annually; however, future plans include reduction in burn frequency as bottomland hardwood restoration goals are achieved (Steve Widowski, pers. comm. 2004).

Water Level Management

Water level management includes both small and large-scale drawdowns to expose and consolidate sediment, stimulate valuable vegetation, and simulate natural river processes. In addition, water level management includes moving navigation pool regulation on Pools 16 and 25 from hinge point to dam point control, resulting in an estimated 1500 additional acres of inundation in the lower third of each of these two navigation Pools. Pool 16 is northward of recent Indiana bat collection, and moving its control point is therefore not anticipated to affect the species. Inundation of additional acreage in Pool 25 has the potential to increase stress and mortality on trees in the lower pool, and will thus contribute to the total number of snag trees available to roosting bats. Moving the control point will change the seasonal water surface profiles in a way that is anticipated to reduce regeneration potential in the lower navigation pool and improve regeneration potential in the upper navigation pool; therefore, the long term net

effect on total available habitat may be undetectable. Thus we believe it will have no net effect on the species, after the initial increase in available roost trees.

Backwater Restoration

Backwater restoration will primarily involve dredging and dredged material placement, some of which may be used for island construction, and some of which may be used to create topographic diversity beneficial to a variety of terrestrial plants and animals. Dredged material placement often involves the deployment of standard construction equipment at the target locations and has the potential to modify or destroy roosting areas. This would place increased energetic demands on displaced bats, and, depending on the season and location, affect maternity success. Impacts to roost trees are expected to be minimized through implementation of the proposed conservation measures and maintenance of site characteristics.

Side Channel Restoration

Side channel restoration may potentially affect Indiana bats where construction activities involve shoreline work, construction equipment access, and roost tree removal. Such effects would be minor, temporary, and localized. There is no guarantee that suitable roost trees existing along banklines can be avoided for all projects, resulting in displacement of roosting individuals.

Implementation of the proposed conservation measures and maintenance of overall site suitability is expected to minimize effects to roost area characteristics.

Wing Dam and Dike Alteration

Wing dam and dike alteration is anticipated to be primarily performed by waterborne equipment and has minimal potential to affect Indiana bats because forested habitats will not be affected.

Island and Shoreline Protection

Island and shoreline protection potentially affecting roost trees is proposed over a total length of 148 miles in this same portion of the study area. This bankline total includes that work proposed to offset navigation-induced erosion (mitigation) and that work proposed to protect or restore shorelines and islands as part of the ecosystem component. Impacts would be expected in the form of tree removal during bank shaping and preparation for rock placement. Effects to bats would be realized in the form of increased energetic demand from primary roost tree displacement.

Administrative actions

Administrative actions are not anticipated to affect the Indiana bat, and are anticipated to facilitate the timely implementation of the conservation measures proposed. In addition, implementation of the adaptive management approach may contribute to the recovery of the species by filling in knowledge gaps through project monitoring and performance evaluation.

Interrelated and Interdependent Actions

Interrelated and interdependent actions associated with the proposed project include Port and facility development resulting from increased navigation system capacity. Such future development would have no independent utility apart from improved system capacity and could adversely affect the Indiana bat. The water-dependent location of such facilities could place them in riparian areas commonly used by the Indiana bat. Large-scale clearing for port facility construction could render previously unknown individual roost trees or an entire roosting area unsuitable for continued occupation by male bats or a maternal colony. Displacement effects would be the same as those noted previously in *Direct Effects*, preceding. Implementation of the proposed conservation measures is expected to minimize adverse effects to the species, and for those avoidable adverse effects, the Tier II consultation process described previously will be initiated.

Indirect Effects

Under the subject consultation the Service considers fleeting to be an indirect effect, since the improved navigation project may alter efficiencies in fleet locations and sizes, and thereby result in additional fleeting activity. Such activity is reasonably certain to occur as evidenced by permits sought/issued in the Rock Island District of the Corps. Fleeting and temporary casual mooring present the potential to alter bankline habitat characteristics by girdling and toppling trees during the hibernation period (i.e., adversely altering the suitability of roosting and foraging habitat) and has the potential to cause direct mortality through toppling during the non-hibernation and maternity period.

Other indirect effects are anticipated to arise from administrative actions proposed in the recommended plan, primarily partner agencies' adoption of the adaptive management paradigm, in short "learning by doing," and provision of additional Corps authority for ecosystem restoration. It is likely that all effects to listed species subject to this consultation cannot be foreseen at this time. Through Tier II consultations, the Corps will ensure the expected level of impact to Indiana bat will be minimal and will do this by ensuring the character of the habitat will not be reduced. And, in the rare cases where this is unavoidable, the Corps is committed to working with the Service to ensure impacts do not rise to the level of adversely affecting reproduction, numbers, or distribution of the Indiana bat. As part of the adaptive management approach, predictive models are proposed to be developed in the implementation phase of the recommended plan, and will necessarily involve elements of listed species life history. The Service expects that further collaboration among partner agencies to develop, test, and validate assumptions used in such models will result in modifications to the recommended plan that contribute to listed species recovery.

2.3.1.4 Summary

Potential impacts of the recommended plan on Indiana bats involve the cascade of effects resulting from displacement from summer roost trees and roost areas. These effects could include adult mortality from increased energy demands from searching for and establishing new territories, increased inter and intraspecific competition, and increased exposure to predation. Increased energy demands would also be expected to result in slower prenatal development or abortion, delayed parturition, slower postnatal development, delayed weaning and volancy, and

increased juvenile predation risk. These effects would all contribute to decreased recruitment of Indiana bats, a species of known low fecundity. Both navigation improvement and ecosystem restoration actions proposed to be implemented are to be undertaken over a 50 year period and intended to achieve restoration and maintenance of ecological processes representative of large river ecosystems. Implementation of the proposed conservation measures will minimize the potential localized adverse effects of individual project actions on Indiana bats.

The disturbance frequency for construction of navigation improvements or ecosystem restoration would be expected to be low, occurring over one multi-year period within the 50 year period of analysis at any given location in the project area. Certain restoration-related habitat maintenance activities such as burning must by necessity be carried out during the non-hibernation period in some locations, and may be expected to occur infrequently on up to 300 acres annually in the portion of the study area where bats are known to roost.

Areas proposed for clearing or new lock construction would be either permanently deforested or require post–project planting which would not restore site character or entirely regain pre-project habitat values before the end of the 50 year analysis period. The severity of disturbance will be highly variable by site and action (navigation construction or ecosystem restoration) selected. Disturbance severity for navigation improvements is expected to reach a peak between 2008 and 2034 based on the proposed schedule for new lock and lock extension construction (USACE 2004b). Disturbance from navigation improvements or ecosystem restoration will involve separate activities at sites spatially distant from each other within the action area. The effects of existing human activity, equipment operation, and navigation traffic on Indiana bats at and around each lock and dam site are unknown. Therefore, the effects of additional personnel and machinery during lock improvement would not be detectable. However, implementation of the proposed conservation measures is expected to limit the exposure of Indiana bats to disturbance from lock construction

Tree toppling due to additional navigation-induced erosion, fleeting or casual mooring, as well as removal for construction area staging lock expansion, mitigation of erosion impacts, or ecosystem restoration during the non-hibernation season may result in mortality to roosting Indiana bats. Prescribed burning, while an infrequent floodplain ecosystem management practice on the UMRS, may result in burning of occupied roost trees outside of the hibernation period (April 1 – September 30). Smoke generated during prescribed burns could also cause roosting bats discomfort or death. Burning may cause an individual roosting bat to abandon a traditionally used roost tree, or a group of bats to abandon a traditional roosting area, thereby requiring a search for and establishment of a new roosting area. Such a requirement in turn would be expected to increase energetic demands, exposure to inter and intra-specific competition, and exposure to predation while searching unfamiliar habitat, resulting in harm or harassment of individual bats.

No direct effects on hibernacula, or designated critical habitat are foreseen from implementation of the recommended plan.

Tree removal activities include: clearing of up to 134.8 acres for navigation improvements, bank stabilization work throughout the lower two thirds of the action area totaling approximately 784,000 feet or 148 miles, and various ecosystem restoration projects involving standard construction techniques and silvicultural (forest management) practices affecting up to

approximately 96,500 acres of all landcover classes in the lower portions of the action area over 50 years, or about 1930 acres annually (USCOE, Henry DeHaan, pers. comm., from tables 6-24, and 14-4 in the Feasibility Report). Of this total acreage, an estimated 10% or 193 acres of forested habitat would be included in implementation of the recommended plan on an average annual basis. Silvicultural practices will generally be directed at uneven-age management and will ultimately benefit the Indiana bat through improved forest structure and species diversity. If bankline work was conservatively estimated to include a strip of forest 50 feet wide, the area associated with 148 linear miles totals approximately 900 acres over the life of the plan, or about 18 acres annually.

2.4 Cumulative Effects

Cumulative effects include the effects of State, local or private actions that may occur in the action area. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of ESA. State-owned and managed lands in the action area in Illinois comprise about 61,000 acres. Actions potentially affecting Indiana bats on these lands are limited to timber stand improvement (TSI) work directed at uneven age management, which should be beneficial to the species. Uneven-age forest management should provide a continuous supply of suitable roost trees over the long-term. Burning on State lands in the action area is minimal, unscheduled, and estimated to involve no more than 450 acres. Burning on private lands is unscheduled and occurs on an as-needed basis, primarily to control willow invasion of managed wetlands. State and private activities in the action area involve lands managed for wildlife, and focus on management for moist soil plants and wetland landcover. As roost trees in Illinois occur in highly fragmented bottomland forests close to water (Carter et. al. 2002), and maintenance of wetland landcover within the action area contributes to interspersion of forest and wetland habitats, the effects of current wetland management on Indiana bats should be beneficial. The current acreage and extent of active timber management that occurs on State lands is not known at this time. Private landowners on the Illinois River have actively enrolled in the USDA Conservation Reserve and Enhancement Program and have planted 3,300 acres of trees on former agricultural land, which is anticipated to benefit Indiana bats as future roosting and foraging habitat. Enrollment in the riparian buffer practice totals over 20,000 acres in Illinois and includes grasses, shrubs, and trees planted to stabilize streambanks and benefit aquatic life. Improved water quality and resultant increase in aquatic life will improve the insect forage base for Indiana bats. Enrollment in the new 2004 bottomland tree practice (CP 31) under the Conservation Reserve Program has just begun, with State-wide targets of 75,000 acres each for Missouri and Illinois. It is thus anticipated that, overall, private landowners will contribute to restoring landcover beneficial to the Indiana bat through their participation in USDA programs.

The Service is unaware of any other non-Federal actions that are reasonably certain to occur which may affect the Indiana bat. We are aware that that floodplain lands in private ownership associated with floodplain restoration contain approximately 7 percent forested lands; however, private management initiatives are unknown and their impact cannot be quantified at this time. Unforeseen non-Federal actions in the floodplain of the Illinois and Upper Mississippi Rivers will likely require Federal review under Section 404 of the Clean Water Act or Section 10 of the Rivers and Harbors Act. Given appropriate environmental

coordination, impacts to the Indiana bat can be avoided. Therefore, any cumulative effects due to non-Federal actions are considered to be negligible.

2.5 Conclusion

After reviewing the current status of the Indiana bat, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the Service's biological opinion that the proposed action is not likely to jeopardize the continued existence of the Indiana bat, and is not likely to destroy or adversely modify designated critical habitat.

The proposed project is not expected to affect hibernating activities or habitat. Implementation of the recommended plan, however, presents the potential to affect summer habitat for both female and male Indiana bats. In addition, small portions of the action area fall within a 5 mile radius of some hibernacula, and thus would be expected to support swarming activity in the fall. Although infrequent and likely to be minimized by the conservation measures proposed, it is likely that adverse impacts to the individuals of the species cannot be avoided entirely over the project life, and take will occur. Potential impacts to Indiana bat habitat from 7 navigation improvement projects range from clearing 5.8 acres to 43 acres on a single-event basis. Potential impacts from the ecosystem restoration component to forested areas presenting potential roosting habitat features are estimated to occur on a maximum of 511 acres distributed over multiple project sites annually. Based on the preceding estimates of the small percentage of total forested habitat affected, and conservation measures proposed by the action agency, it is expected that adverse impact to Indiana bats will be minimized but, due to the unknown distribution of roosting bats on a site-specific basis, not avoided entirely. Because site specific adverse impacts to Indiana bats are likely in only a few instances, we believe implementation of the recommended plan will not appreciably reduce reproduction, numbers, or distribution of Indiana bats within the action area or appreciably reduce the likelihood of recovery of the species over 50 years. Critical habitat for the Indiana bat has been designated at Blackball Mine; however, implementation of the recommended plan does not affect that site and no destruction or adverse modification of that critical habitat is expected.

2.6 Incidental Take Statement

2.6.1 Introduction

Section 9 of the ESA and Federal regulations pursuant to section 4(d) of the ESA, prohibits the take of endangered and threatened species, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of Section 7(b)(4) and Section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below are non-discretionary, and must be undertaken by the Corps so that they become binding conditions of any grant or permit issued to an applicant, as appropriate, for the exemption of Section 7(o)(2) to apply. The Corps has a continuing duty to regulate the activity covered by this Incidental Take Statement. If the Corps (1) fails to assume and implement the terms and conditions, or (2) fails to require an applicant to adhere to the terms and conditions of the Incidental Take Statement through enforceable terms that are added to the permit or grant document, the protective coverage of Section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the Corps must report the progress of the action and its impact on the species to the Service as specified in the Incidental Take Statement, pursuant to 50 CFR § 402.14(i)(3).

2.6.2 Extent of take anticipated

Incidental take of Indiana bats is expected to be in the form of injury, death, harm, or harassment of individuals. Given the conservation measures proposed by Corps, we do not anticipate any direct take of Indiana bats to occur where their presence is verified. Furthermore, as the Corps is committed to maintaining the suitability of potentially occupied sites, we do not anticipate that indirect take resulting from habitat alterations during the inactive season will result in loss of individuals. However, as our survey methodologies and information regarding the exact location of individual bats at any one moment is imprecise, we cannot ensure that the conservation measures proposed will avoid altering habitat currently being used by individuals. However, we believe following suitable survey protocols, considering past and present survey efforts and their results, habitat suitability of the area, etc., will greatly minimize the chances of concluding not present when indeed they are present. This is especially true for maternity colonies as the number of bats in a given area would be greater than for solitary males, and hence, reproductive females are more likely to be caught. Moreover, as the proposed action will span 50 years and will entail actions that occur within seemingly suitable habitat, we are reasonable certain that incidental take of a few individuals over the term of the project is likely.

Due to programmatic nature of the project, we are unable to determine where and when this take will occur. Furthermore, we also anticipate that incidental take of Indiana bats will be difficult to detect because (1) dead or injured bats are rarely discovered due to the bat's small body size; and (2) the number of bats occupying a particular area at a particular time is highly variable and difficult to determine. Thus, it is appropriate to use a surrogate to monitor the level of take that occurs. The Service typically uses the areal extent of potential roosting habitat affected as a surrogate to monitor the level of take. Such monitoring, described at the end of this section, typically quantifies the actual versus projected amount of habitat harvested, and number of live or dead bats encountered, and age, sex, and reproductive status of live bats handled.

This incidental take statement is based on several single event clearings not to exceed an aggregate 135 acres for navigation improvement (see Table 2), and annualized timber stand improvement and tree removal activities occurring during ecosystem restoration work on an average of 193 acres, bankline work on approximately 18 acres, and prescribed burning on a maximum of 300 acres, for a total forest impact of about 511 acres annually. Since the level of incidental take of Indiana bats cannot be adequately quantified, incidental take will be estimated by the loss or abandonment of roost trees potentially occupied by Indiana bats that are contained within the total 511 acres of forested habitat estimated to be affected annually. These estimates of habitat alterations are described in the *Direct Effects Summary* preceding. The proposed

conservation measures will ensure that every effort to identify maternity activity and maternity roosts is taken, this estimate is based on the removal of other undiscovered roost trees used by male bats. Because males roost solitarily or in small groups, we believe that few individuals are likely to be exposed to impacts. Given the proposed conservation measures, we anticipate that the anticipated level of habitat alteration is likely to result in the take of less than 20 bats per year. Management activities on project lands that would significantly increase the number of acres of tree removal or burning during the non-hibernation season would be considered to affect this determination and would require reinitiation of consultation.

2.6.3 Effect of the take

In the accompanying biological opinion, the Service determines that this level of expected take is not likely to result in jeopardy to the species or destruction or adverse modification of critical habitat.

2.6.4 Reasonable and prudent measures

To ensure that the anticipated level of incidental take is commensurate with the take that occurs per the proposed action, the Corps of Engineers (Corps) and the Service is implementing a tiered programmatic consultation approach. This approach utilizes a tiered consultation framework with the subject consultation resulting in this Tier I biological opinion. All subsequent projects will be Tier II consultations with Tier II biological opinions issued as appropriate (i.e., whenever the proposed project will result in unavoidable adverse effects to threatened and endangered species).

As individual projects are proposed under the recommended plan, the Corps shall provide, for any action that may affect Indiana bats, project-specific information to the Service that (1) describes the proposed action and the specific area to be affected, (2) identifies the species that may be affected, (3) describes the manner in which the proposed action may affect listed species, and the anticipated effects, (4) specifies whether the anticipated effects from the proposed project are similar to those anticipated in the programmatic BO, (5) estimates a cumulative total of take that has occurred thus far under the tier I BO, and (6) describes any additional effects, if any, not considered in the tier I consultation. If it is determined that the proposed project may affect the Indiana bat, the Corps will provide this information in a tier II BA to document anticipated effects of the subject action.

The Service will review the information provided by the Corps for each proposed project. If it is determined during this review that a proposed project is not likely to adversely affect listed species, the Service will complete its documentation with a standard concurrence letter and specifies that the Service concurs that the proposed project is not likely to adversely affect listed species or designated critical habitat.. If it is determined that the action is likely to adversely affect listed species or designated critical habitat and these effects are commensurate with those contemplated in the programmatic BO, then the Service will complete a tier II BO with a project-specific incidental take statement within the annual allotted programmatic incidental take, and project specific Reasonable and Prudent Measures and Terms and Conditions, if appropriate.

The Service believes the following reasonable and prudent measures are necessary and appropriate to minimize impacts of incidental take of the Indiana bat:

1. Protect those portions of swarming areas (5-mile radius around hibernacula), maternity colonies, and male home range (2 mile radius around roost trees or capture sites) on Project (fee title or General Plan) lands by establishing management areas and prescriptions that focus ecosystem restoration measures compatible with Indiana bat management.

2. Where evidence of possible maternal colonies (lactating females or juveniles prior to August 15) is discovered, in addition to preserving the character of the site, the Service and appropriate state will be notified to determine the feasibility of project deferral, relocation, or modification. Recommendations for further site monitoring will be developed in cooperation with the Service and appropriate state.

Terms and Conditions

In order to be exempt from the prohibitions of Section 9 of the Act, the Corps of Engineers must comply with the following terms and conditions. These terms and conditions are non-discretionary.

RPM 1.

1. Management area establishment and prescriptions will be reflected in site-specific planning documents that include, but not be limited to, detailed pre and post-project monitoring, site suitability enhancement, and post-project land use (types and levels of recreation) management.

2. Monitor snag (standing dead or dying trees over nine inches diameter at breast height (dbh)) retention through routine forest inventory on project lands. If there exists an average of less than 6 snags per acre, manually create additional snags greater than 9 inches dbh. This is intended to maintain a supply of suitable roost trees.

3. Where feasible, conduct prescribed burning activities on fee title or General Plan lands during the period October 1 to March 31 unless within a 5-mile radius of a known hibernacula and then the dates are from November 15 to March 31.

RPM 2.

1. Wherever tree removal is proposed to occur, first evaluate the site potential for roosting habitat. If roosting habitat characteristics are evident, employ more detailed survey methods (such as mist netting) to further evaluate site use by Indiana bats.

2. If site investigations or monitoring activities result in the discovery of maternity sites on Project lands, roost areas used by maternity colonies will be protected by establishing a zone centered on the maternity roosting area. The actual area will be determined by a combination of topography, known roost tree locations, proximity of permanent water, and a site-specific evaluation of the habitat characteristics associated with the colony. Protective measures shall be established by developing a management strategy in cooperation with the Service and the appropriate state. Strategies may include such things as survey/monitoring plans, site enhancement plans, and land use plans.

Requirements for Monitoring and Reporting of Incidental Take of Indiana Bats

Federal agencies have a continuing duty to monitor the impacts of incidental take resulting from their activities [50 CFR 402.14(i)(3)]. In doing so, the Federal agency must report the progress of the action and its impact on the species to the Service as specified below.

1. Supply the Service with an annual report, due by January 31 of each following year, that specifies:

    a. the amount of suitable habitat harvested in the current year and the total harvested since issuance of the BO,
    b. progress and results of any terms and conditions that were required, identified by site-specific project,
    c. the number of live or dead Indiana bats encountered, and
    d. age, sex, and reproductive status of live bats handled.

2. Care must be taken in handling dead bat specimens that are found on project lands to preserve biological material in the best possible condition.

3. Any dead specimens found should be placed in plastic bags and refrigerated as soon as possible following discovery.

4. The finding of any dead specimen should be reported immediately to the Service's Rock Island Field Office.

Closing

The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize the impact of incidental take that might otherwise result from the proposed action. If, during the course of the action, this level of incidental take is exceeded, such incidental take represents new information requiring reinitiation of consultation and review of the reasonable and prudent measures provided. The Federal agency must immediately provide an explanation of the causes of the taking and review with the Service the need for possible modification of the reasonable and prudent measures.

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